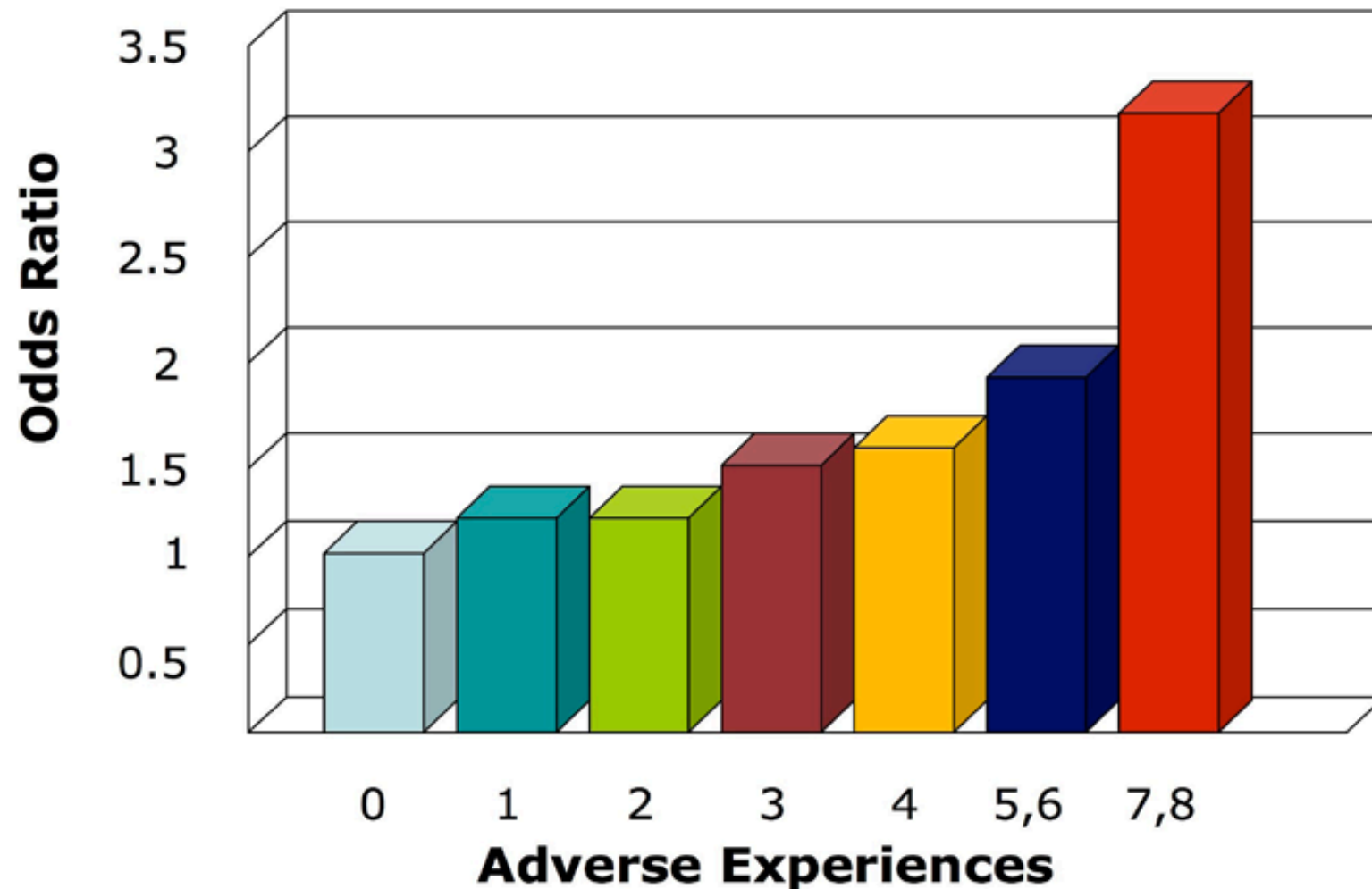


What Can Brain Science Tell Us About the Influences of the Environment on Children's Healthy Development?

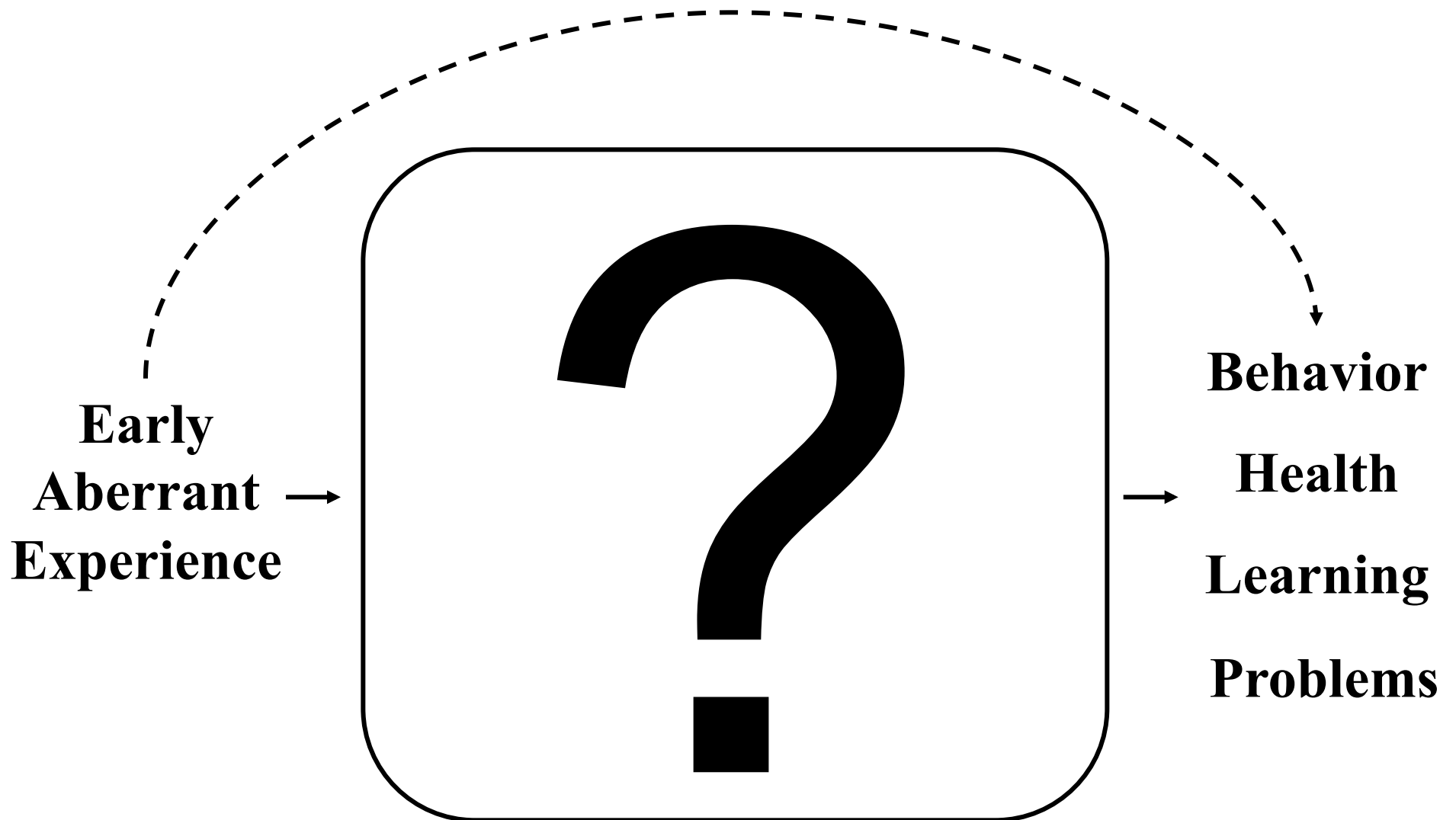


Seth Pollak
University of Wisconsin - Madison

Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences



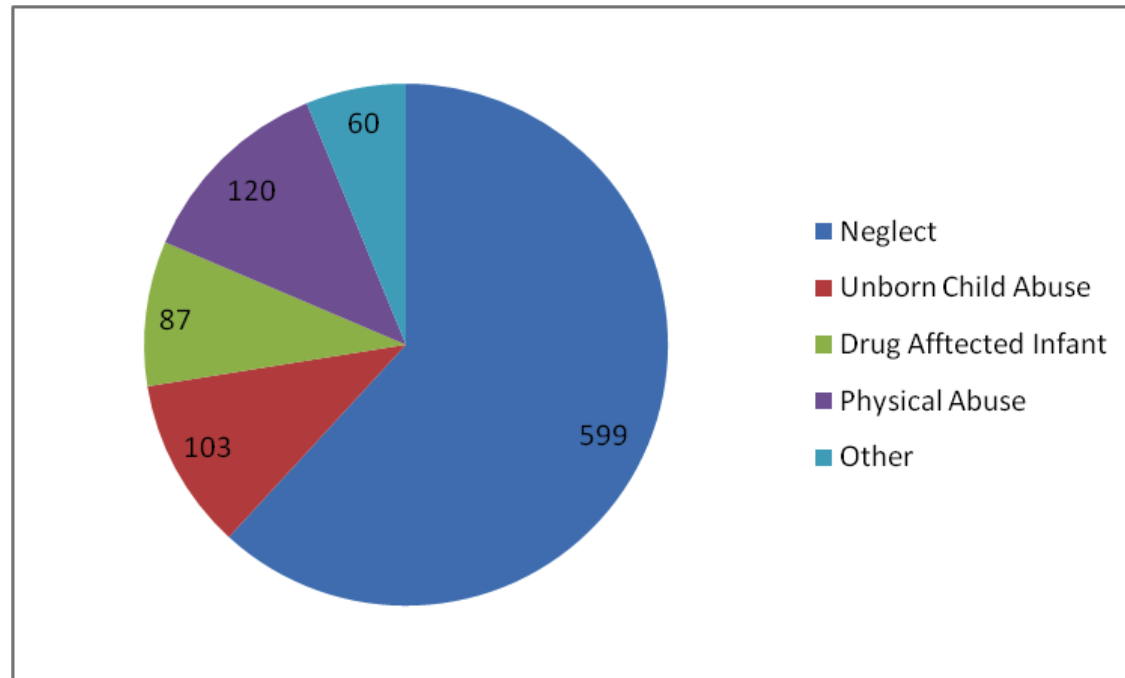
Source: Dong et al, 2004



Neglect is the most common form of child maltreatment

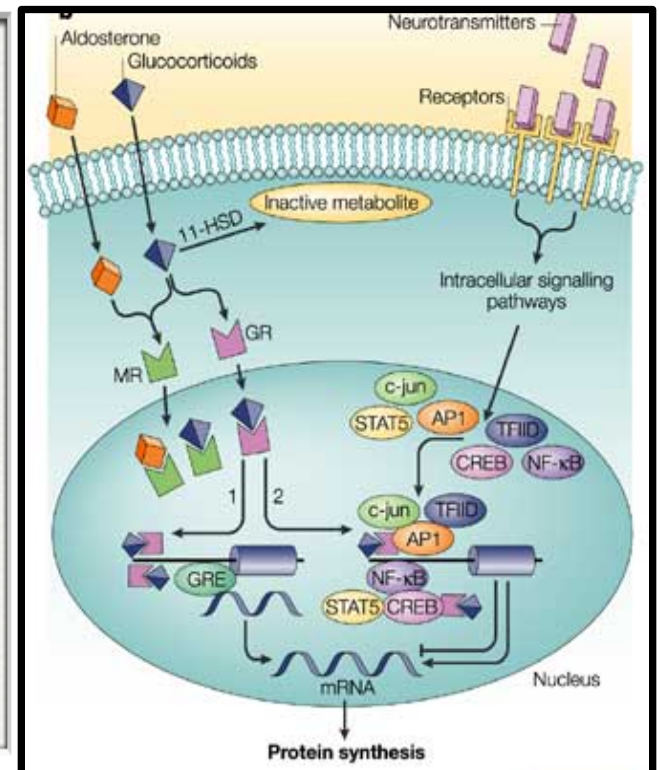
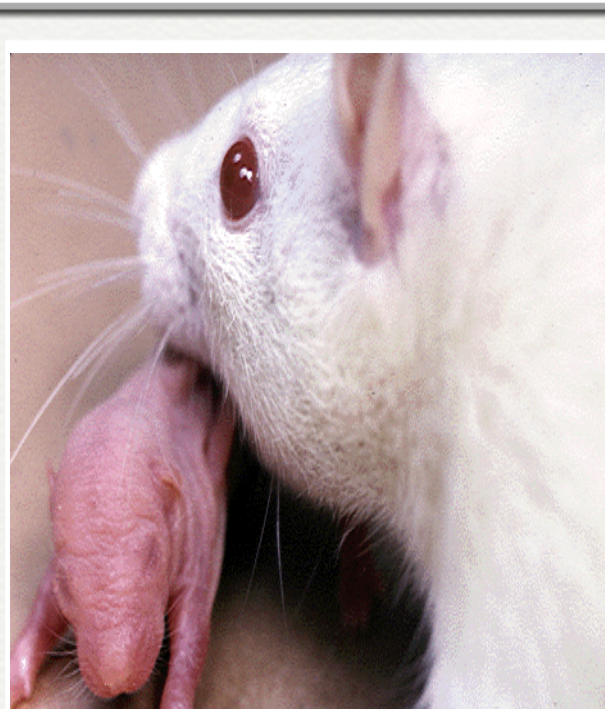
Epidemiologists argue that the actual incidence of child neglect is ten times the number of substantiated cases.

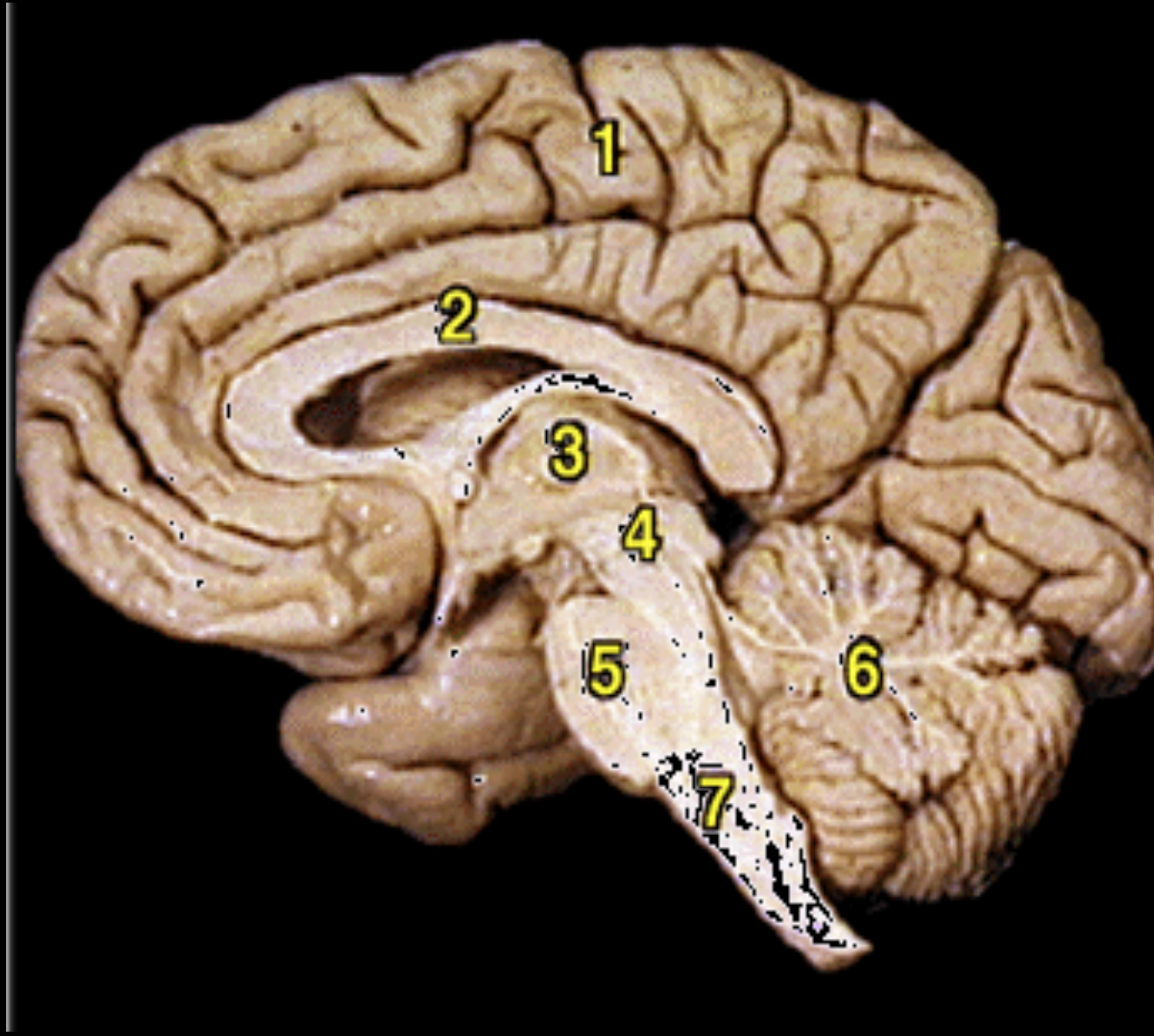
In Wisconsin last year, 77% of substantiated allegations for infants (less than 1 year) were neglect allegations.

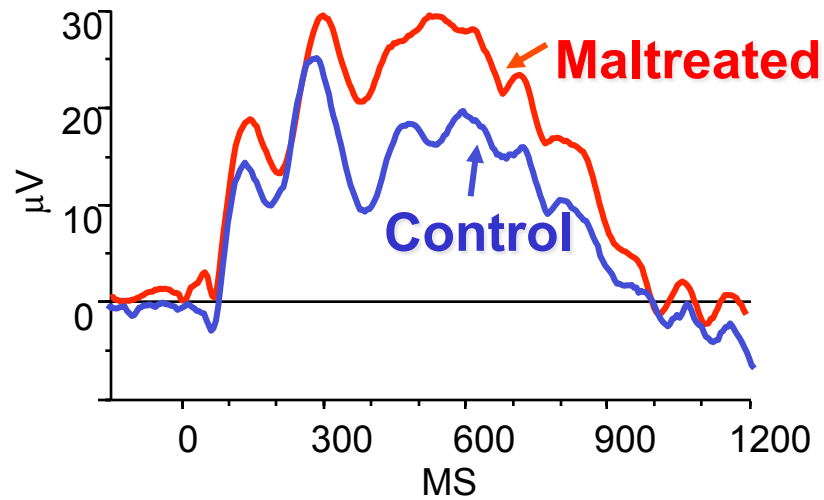
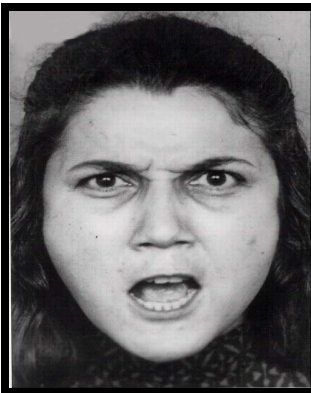
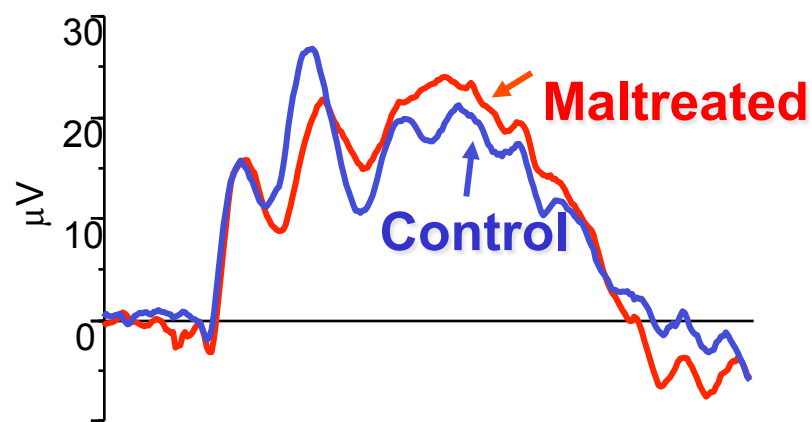
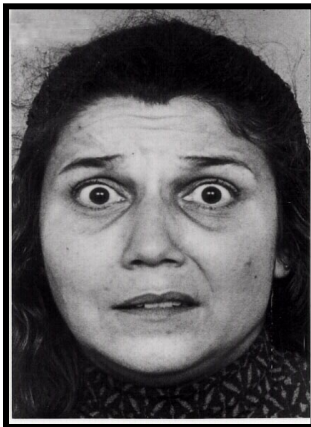
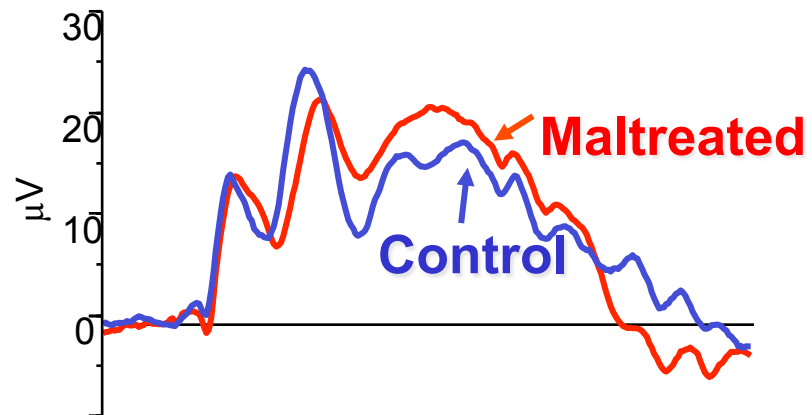


Biological Embedding

How experience gets under the skin and alters human development in ways that influence health, well-being, learning, and behavior throughout life.







Pollak et al. (1997), *Child Development*; Pollak et al. *Psychophysiology* (2001); Pollak et al. *Emotion* (2008)

The frontal lobe is the brain's “executive.”

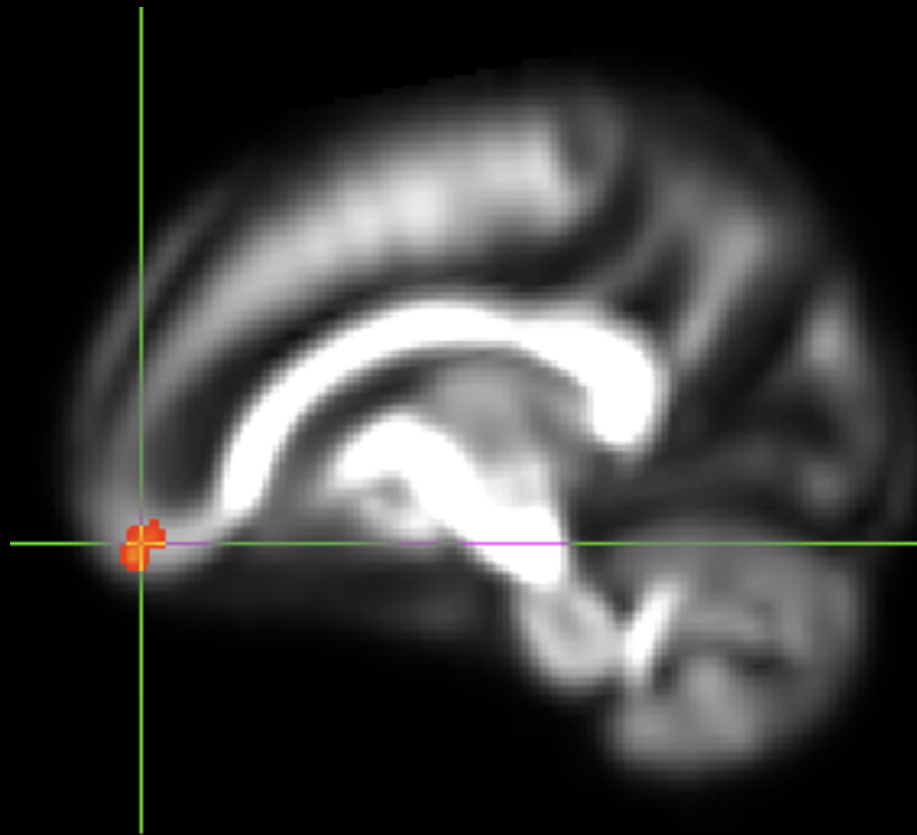


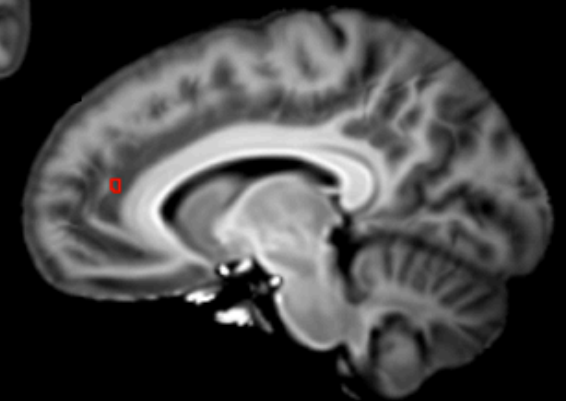
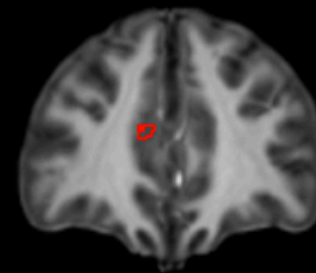
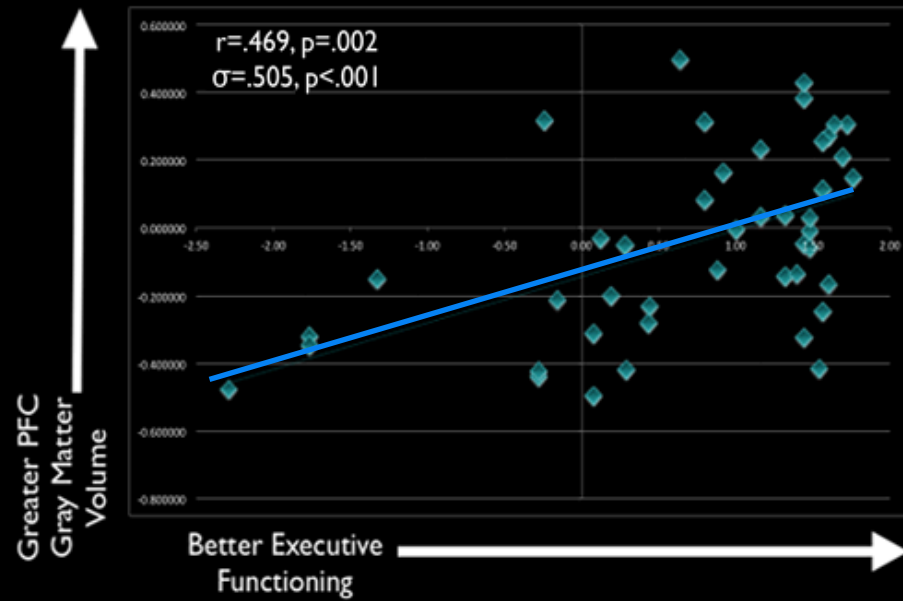
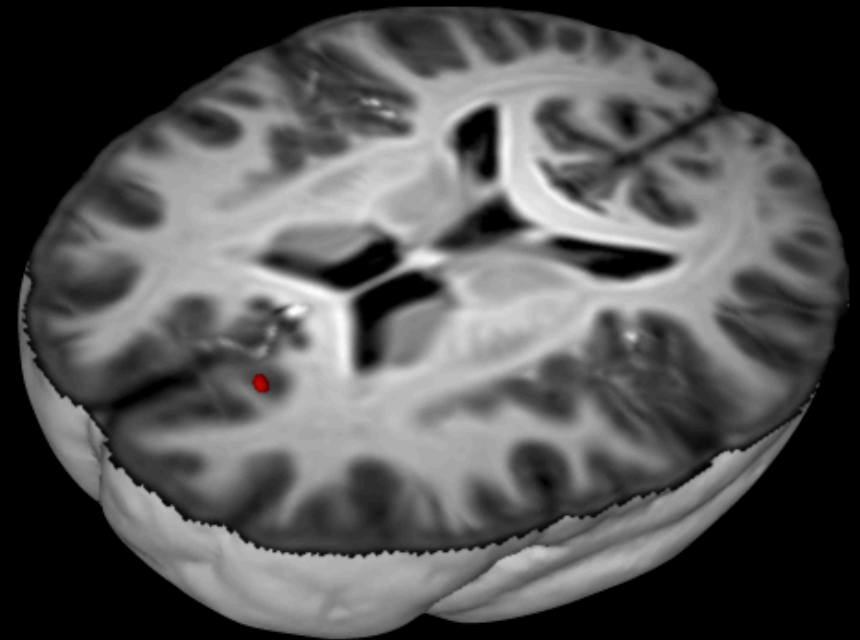
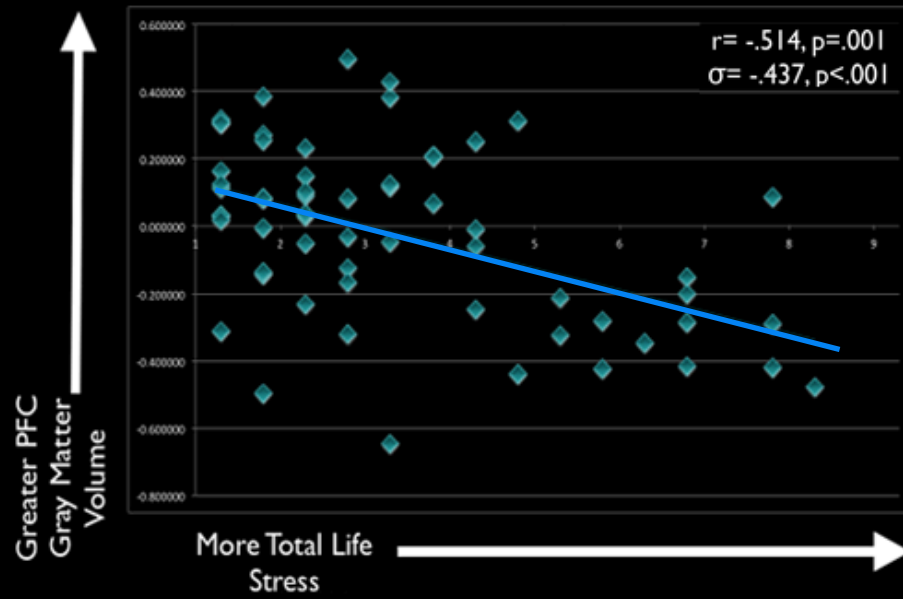
It contains the neurons associated with reward, attention, short-term memory, planning, behavioral control, and motivation.

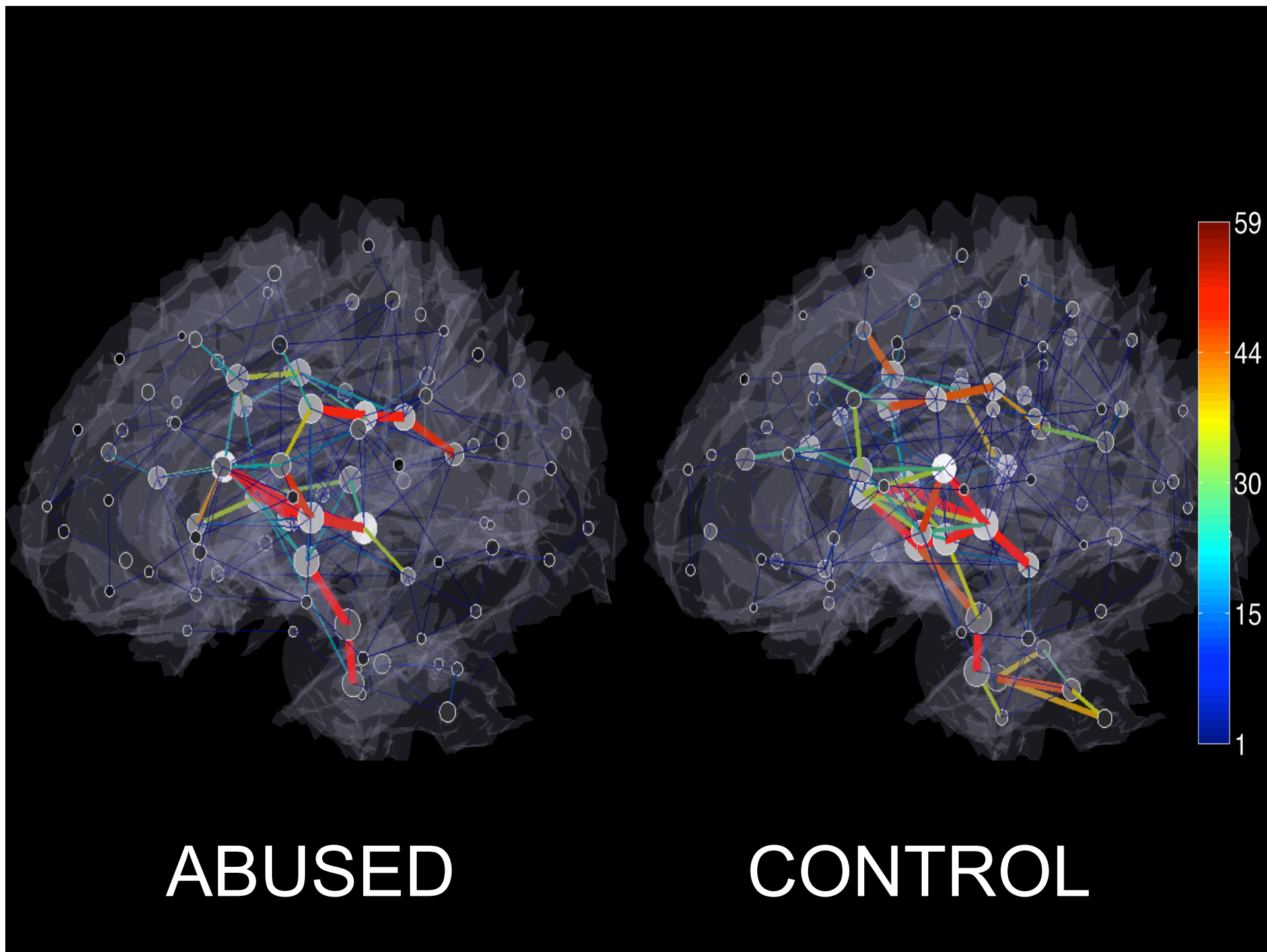
Early stress ->

Poor connectivity in PFC →

Lower cognitive performance

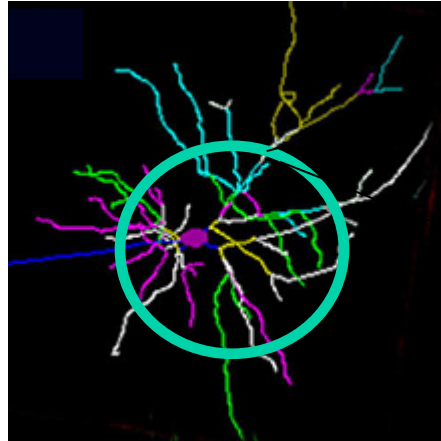






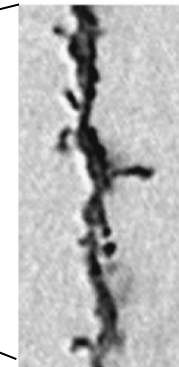
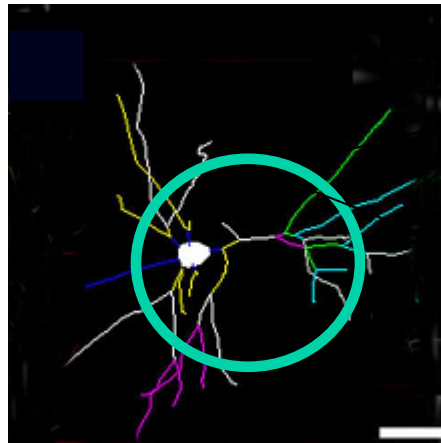
Persistent Stress Changes Brain Architecture

Normal



Typical neuron with many connections

Chronic stress



Neuron damaged by stress
– Fewer connections

Prefrontal cortex
and hippocampus

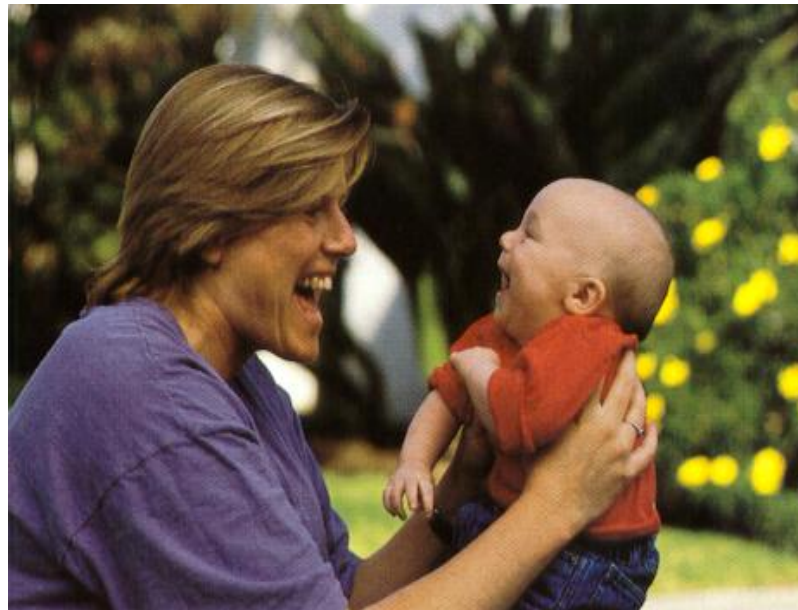
Sources:

Radley et al. (2004)

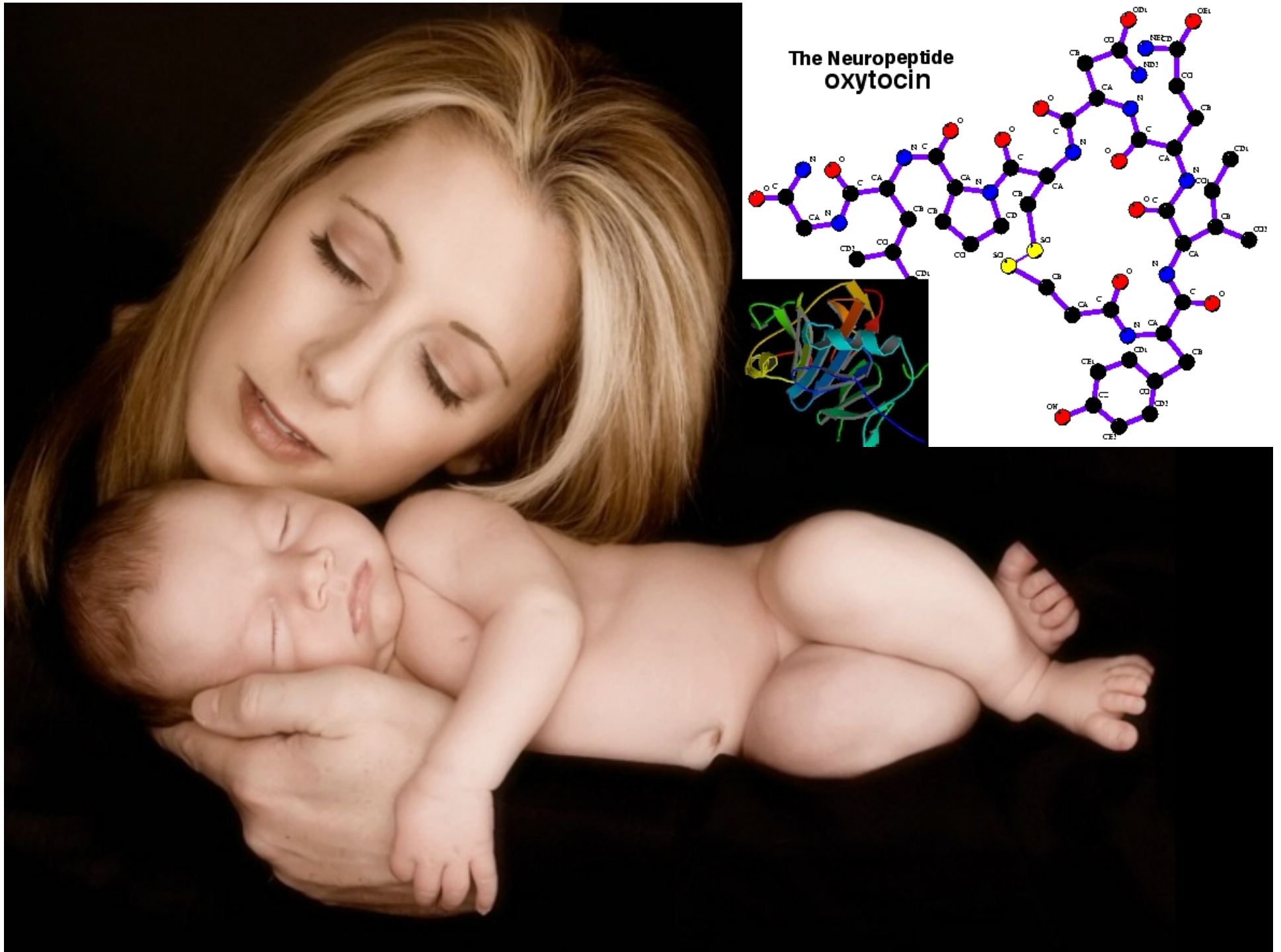
Bock et al. (2005)

Cook & Wellman (2004)

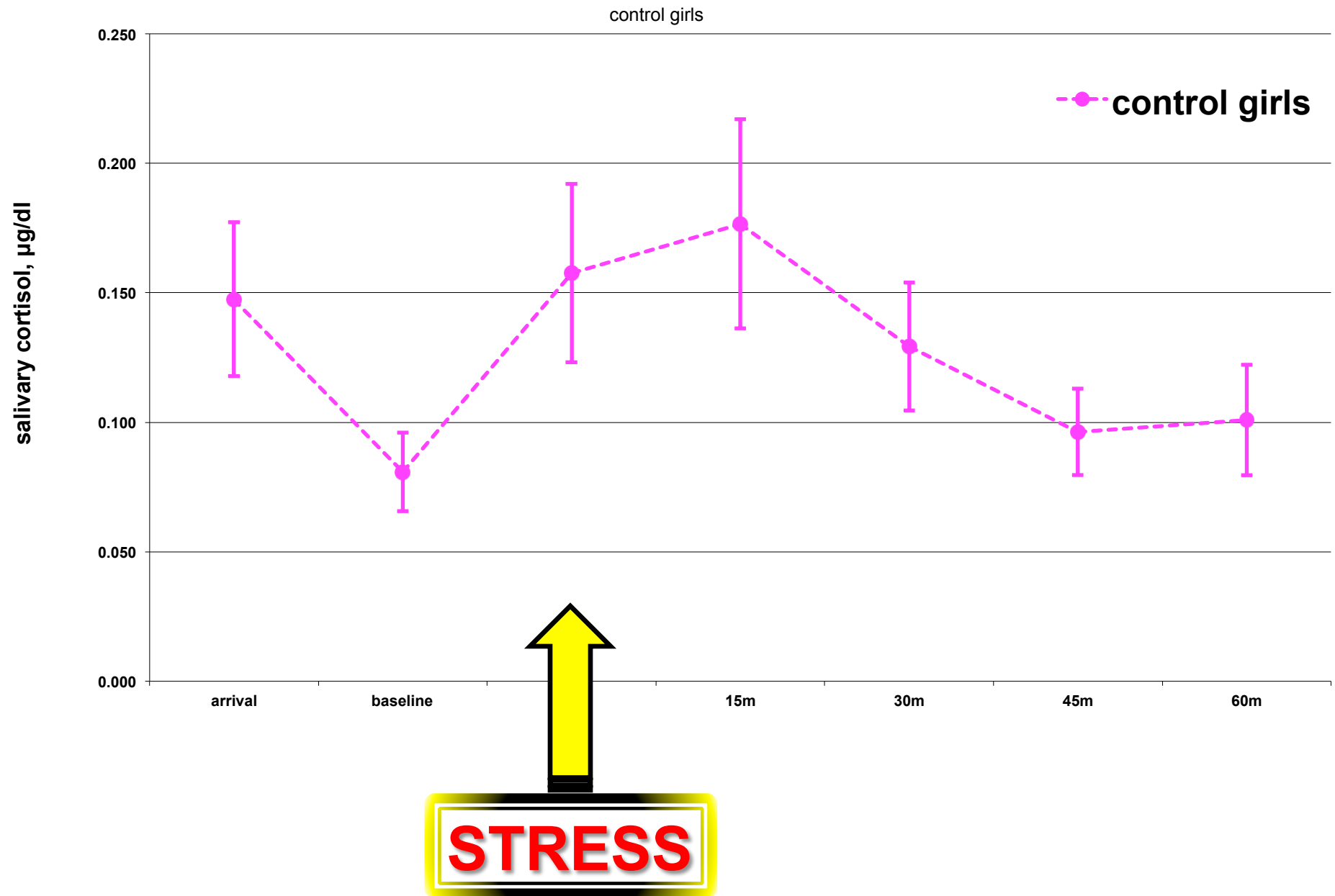
Development of the HPA axis is dependent on children's early life experiences



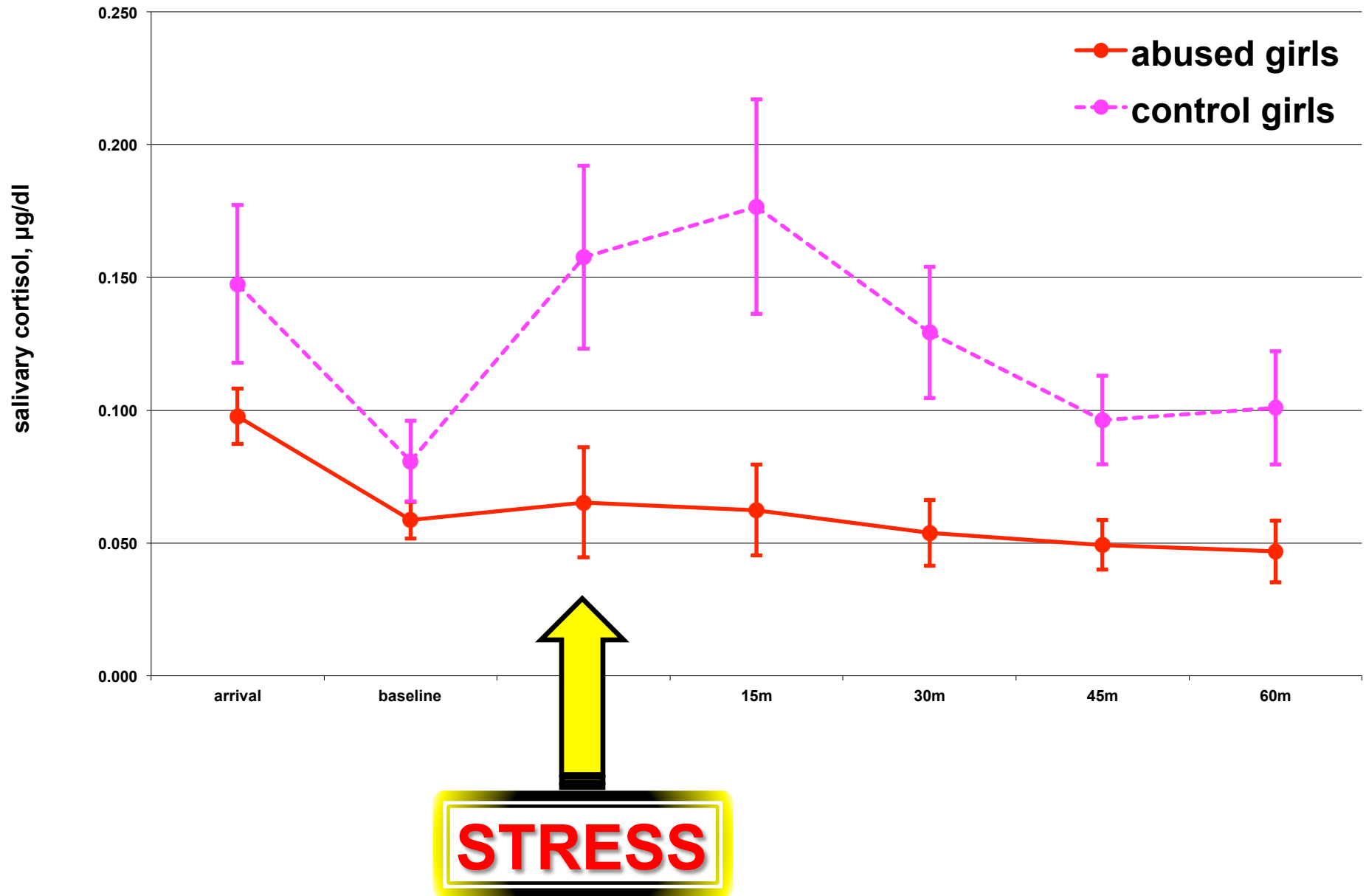
Short bursts are good;
chronic exposure is bad



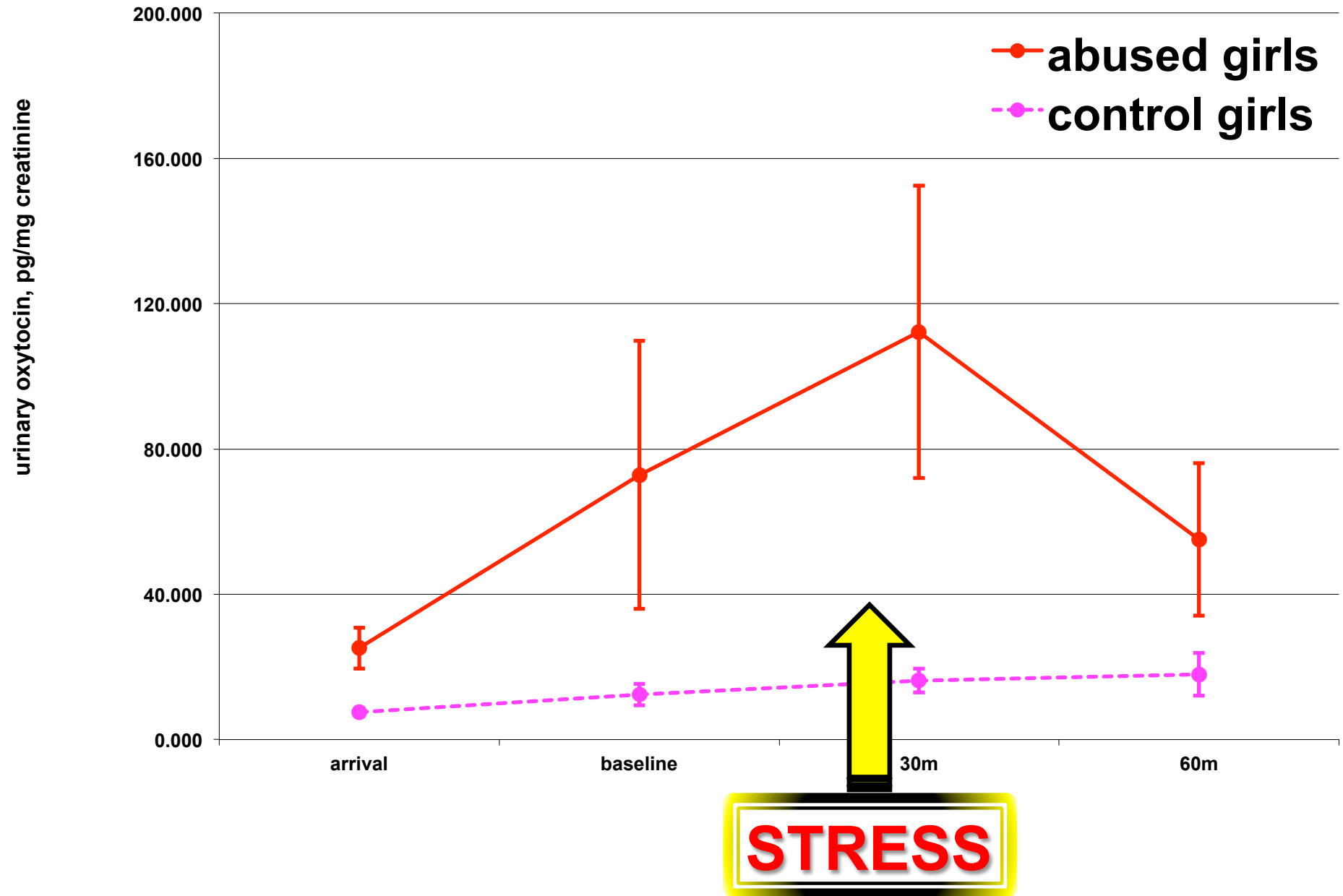
Cortisol Responses to Stress



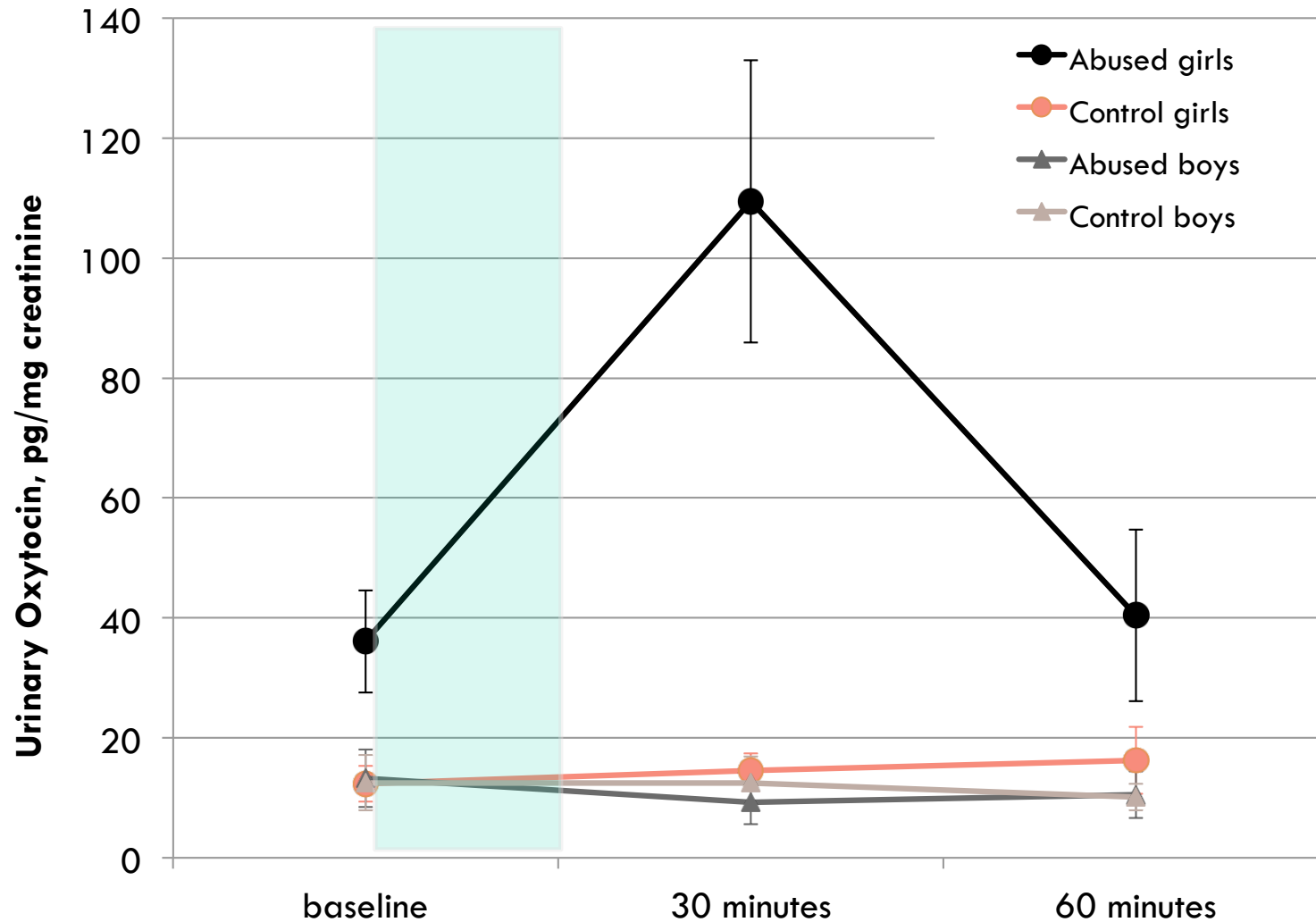
Cortisol Responses to Stress



Oxytocin Responses to Stress



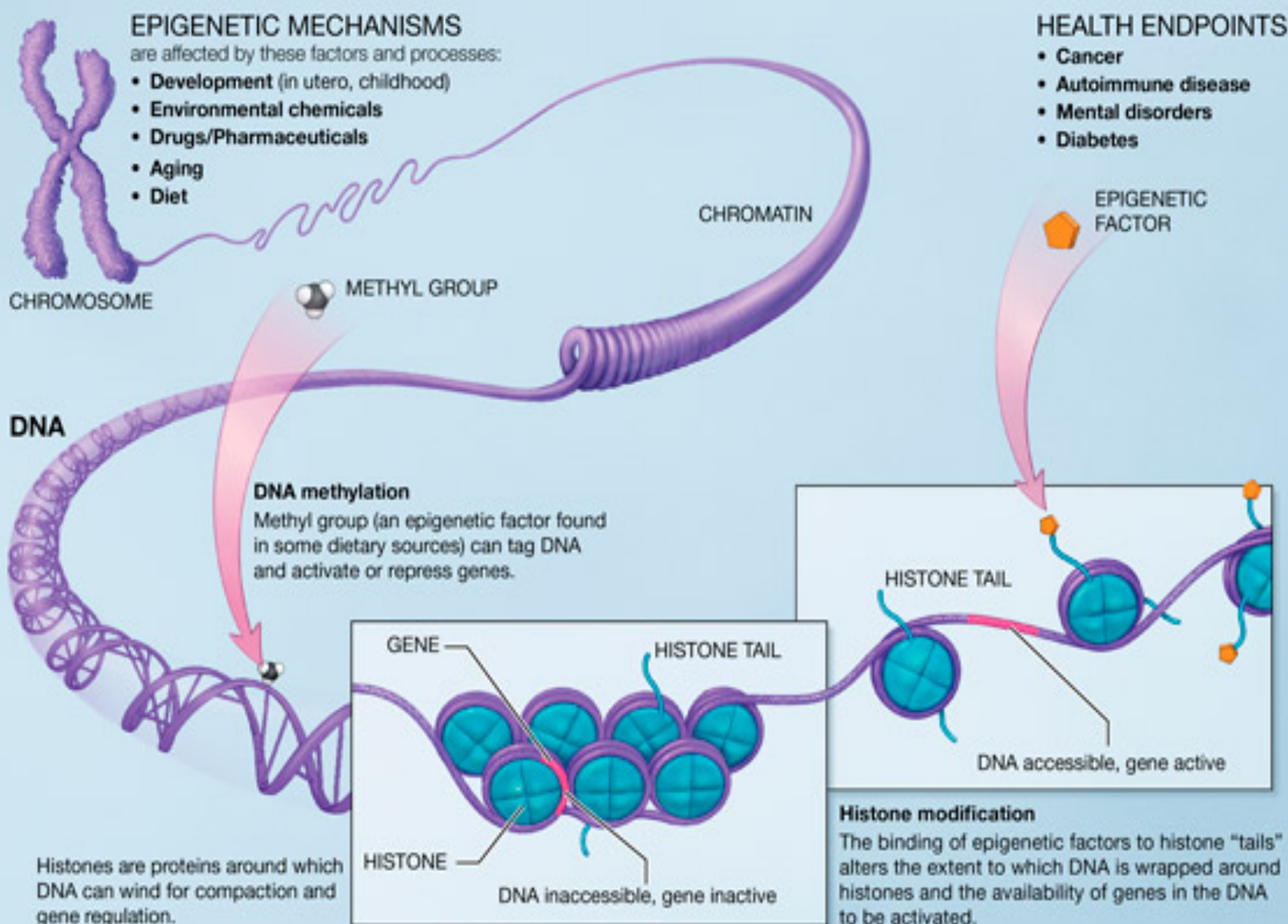
Oxytocin



Seltzer & Pollak (2013), Child Development

Epigenetics

Alterations to the DNA, *other than* changes to the genes themselves, that change normal gene expression



Methylation status of promotor region of glucocorticoid receptor (GR) NR3C1 Gene



Region of the gene identified in rodents as responsive to parental care.

Region of the gene found to be responsive to parental care in human children.

Warning:

Translation across species is
important but difficult!



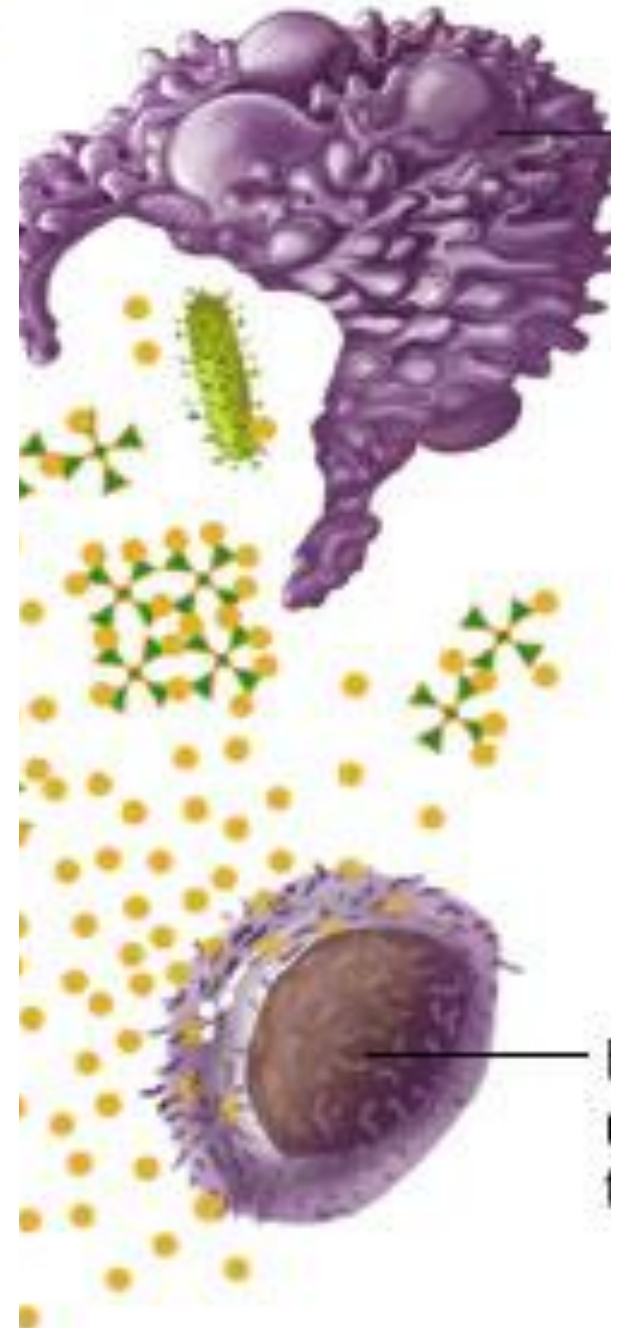
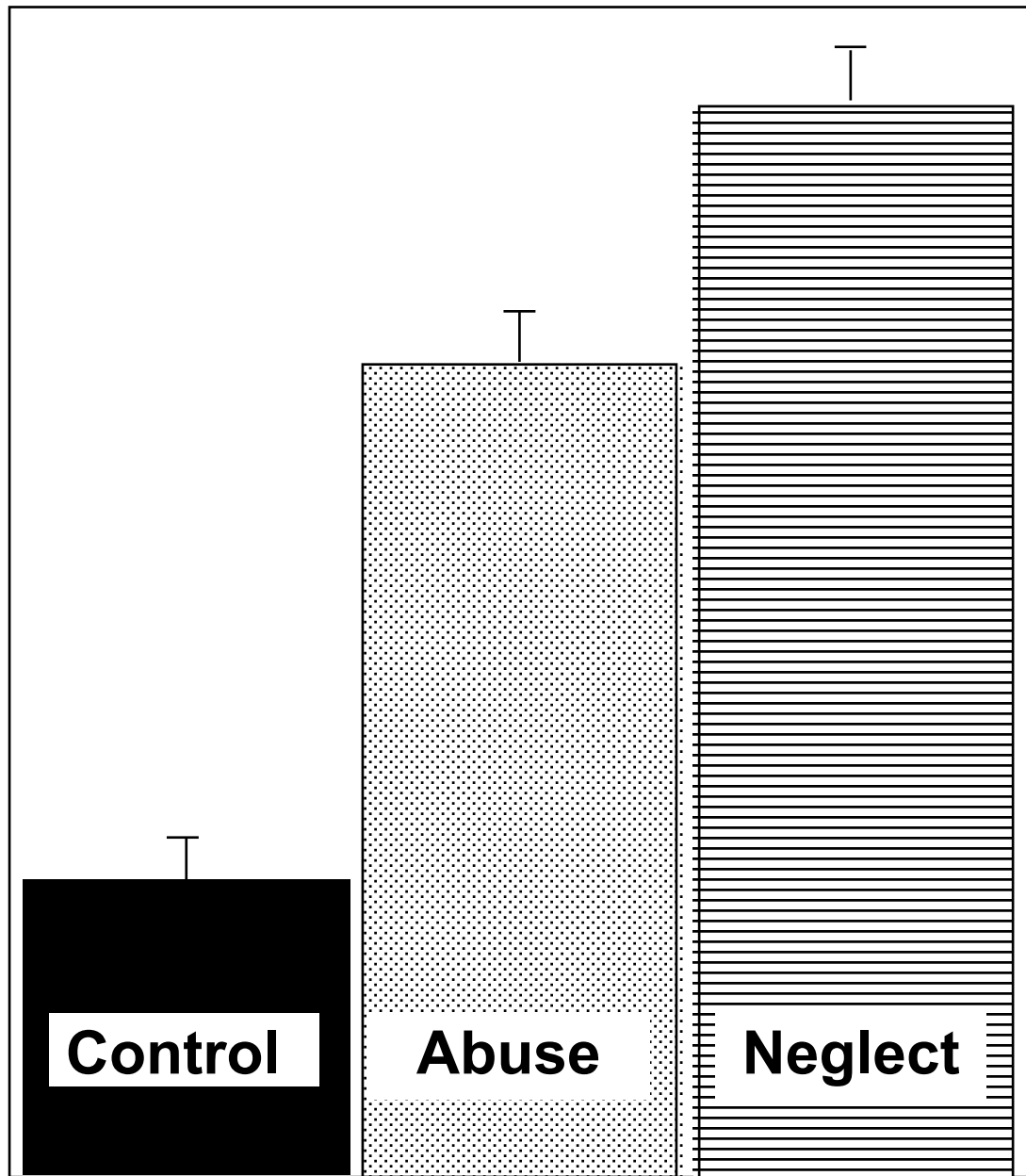
≠



Herpes Simplex Virus

Bad

Good



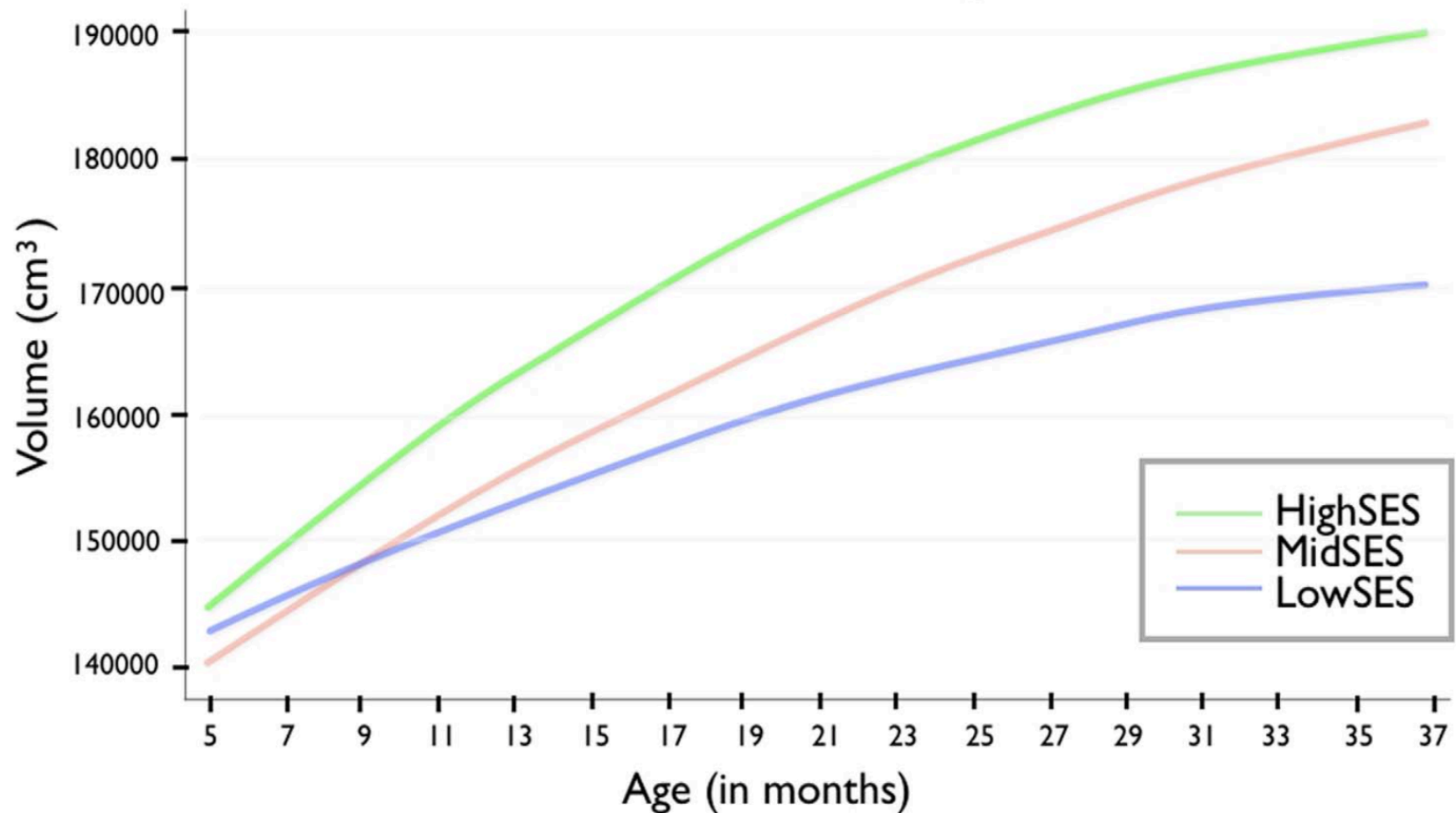
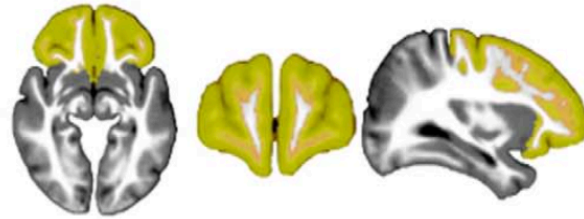
Shirtcliff, Coe & Pollak (2009), *Proceedings of the National Academy of Sciences*



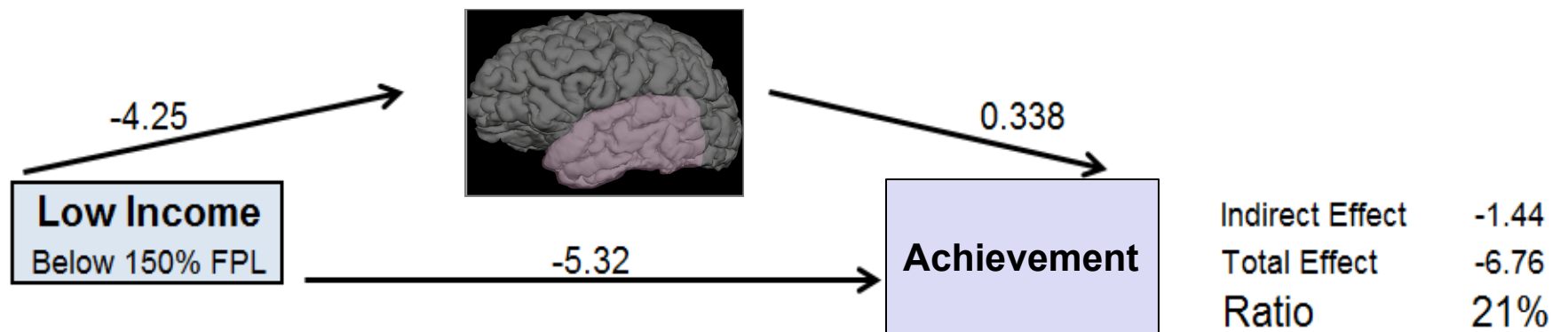
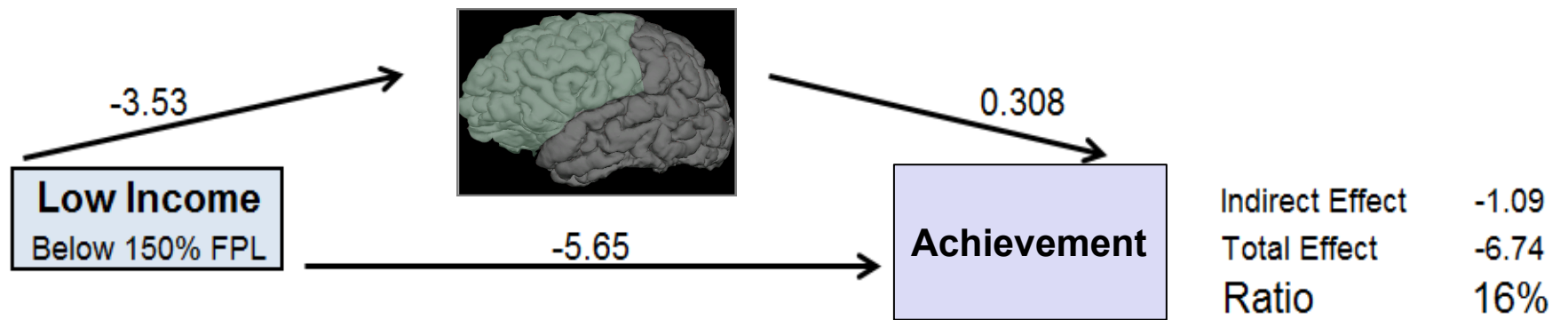
CHILD POVERTY

A NATIONAL DISGRACE

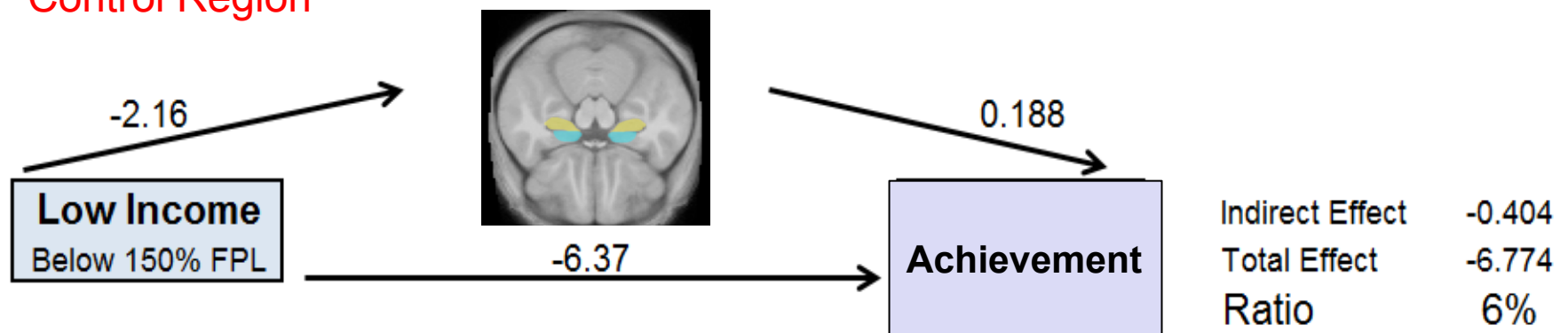
Frontal Gray Matter



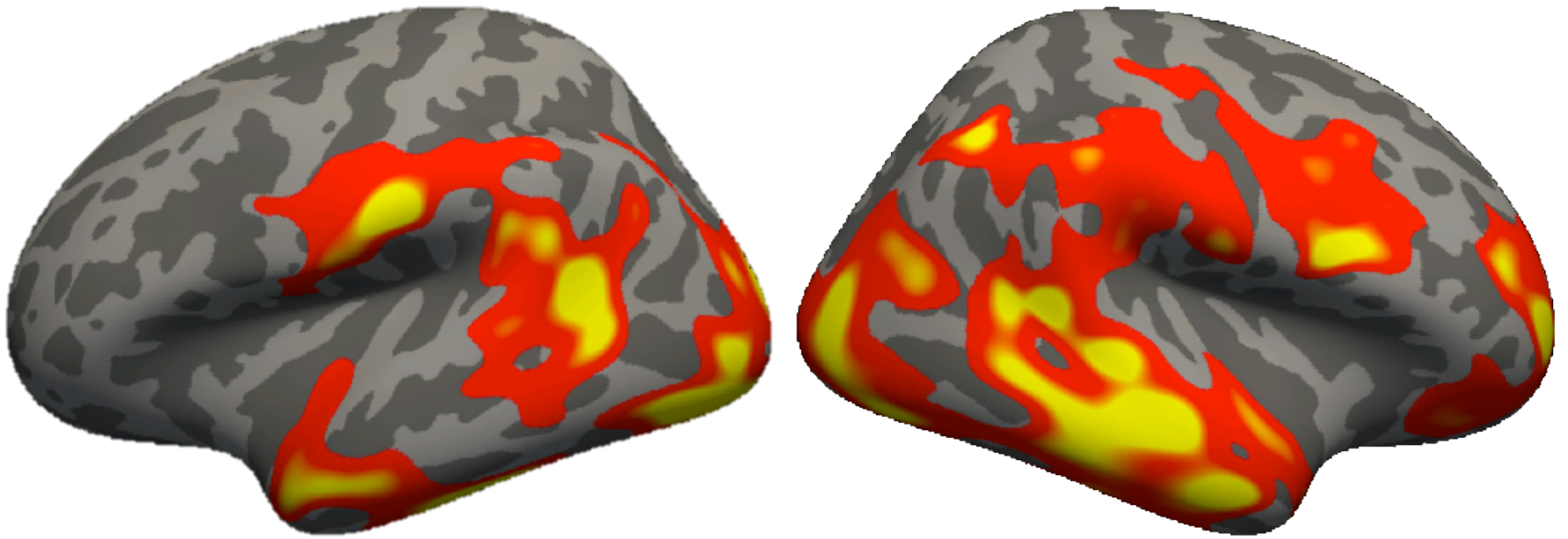
Hanson, et al. (2013) Family Poverty Affects the Rate of Human Infant Brain Growth. *PLoS*



Control Region



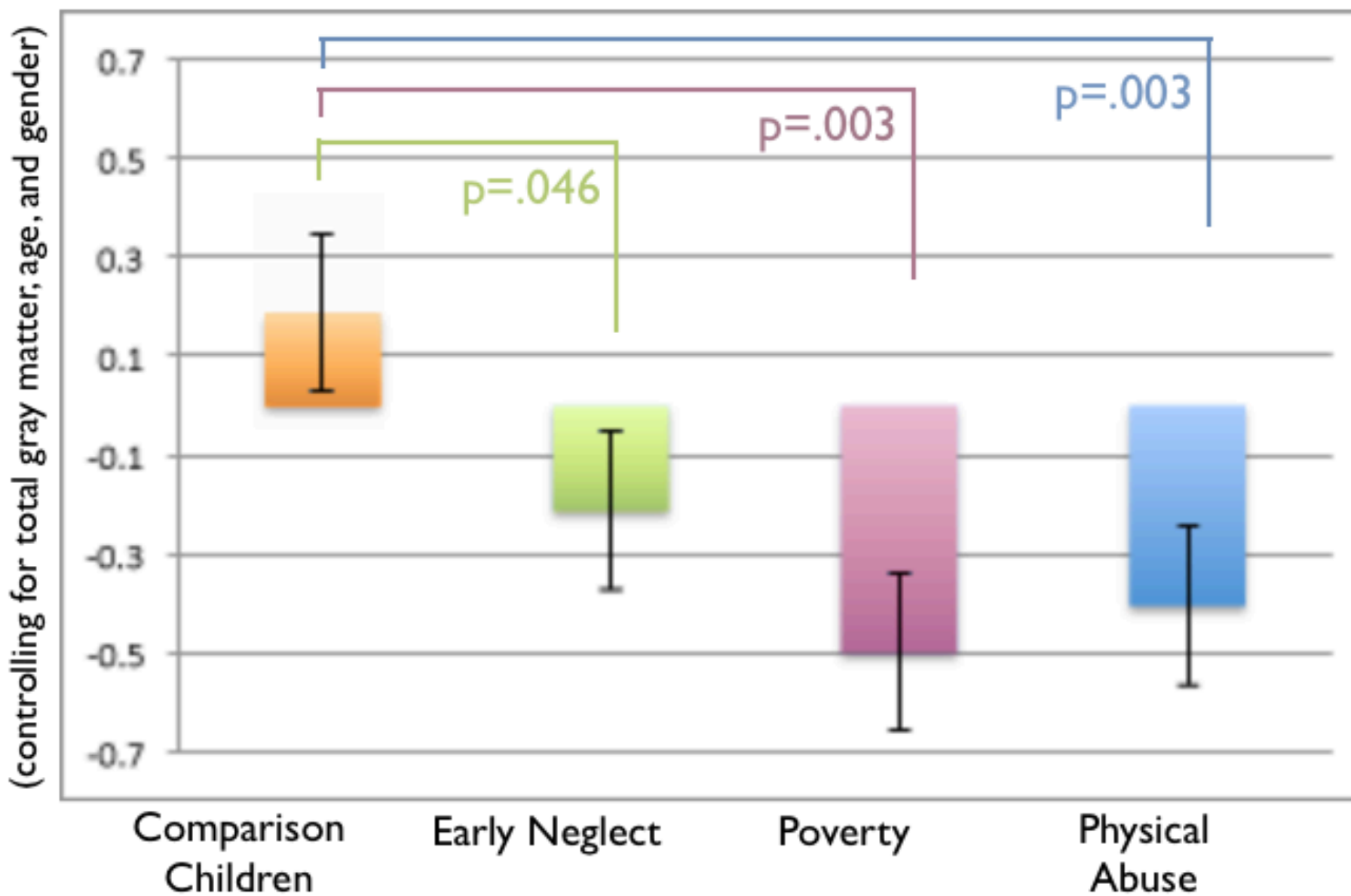
Greater Cortical Thickness With Higher SES (Paid Lunch > Free/Reduced Lunch)



***Greater cortical thickness correlated with
better statewide standardized test scores***

Mackey et al., *Psychological Science*, 2015

Hippocampus Volume



Three Levels of Stress

Positive Stress

**Brief increases in heart rate,
mild elevations in stress hormone levels**

Tolerable Stress

**Serious, temporary stress responses,
buffered by supportive relationships**

Toxic Stress

**Prolonged activation of stress response
Systems in the absence
of protective relationships**

A black and white photograph showing a close-up of a person's hands, likely a parent or caregiver, gently holding a baby's feet. The hands are positioned in the center of the frame, with the fingers wrapped around the baby's feet. The background is dark and out of focus, emphasizing the hands and feet. The overall mood is tender and protective.

**Many aspects of brain
development are tied to
early experience.**

**This provides clues about
effective targets for
intervention but also
possibilities for prevention.**

waisman.wisc.edu/childemotion

